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Nitrous oxides (NOx) are harmful emissions from high temperature combustion processes, especially from Diesel engines, which are becoming more popular in the recent years. The techniques normally used for reducing NOx under an oxygen rich environment are the selective catalytic reduction (SCR) with ammonia/urea and the NOx storage and reduction (NSR). The implementation of these technologies are not straight forward since dosing equipment for the reducing agent in SCR and careful control of the engine in NSR is needed.

In electrochemical cells based on an oxide ion conducting electrolyte, NOx can be reduced at the cathode and the oxygen extracted can in principle be used to oxidize soot particulates at the anode. Such an electrochemical filter will operate much simpler than the catalytic techniques used so far.

At DTU Energy, extensive research has been performed during the recent years to develop electrodes and electro-catalysts for NOx reduction in solid oxide cells operating between 300 – 500 degrees Celsius and also to investigate the effect of simultaneous NOx and soot removal. The main challenge in the electrode development is to suppress the parasitic oxygen reduction at very low NOx contents. Thus, besides selectivity the current efficiency of the electrochemical NOx reduction is a crucial parameter in the evaluation of the electrochemical NOx filters.

A promising strategy is to impregnate porous electrodes based on La-Sr manganite of La-Sr-cobaltite with getter materials for NOx (NOx storage compound) (1) or other active NOx reducing catalysts as well as introducing a NOx adsorption layer (2) in the vicinity of the NOx reducing electrode. High selectivity (80-100%) towards the reduction of NOx to N2 and current efficiencies of above 12% have been achieved (1,2).Current activities are related to optimize the porous structure of the cells (3) and to derive a better understanding of the interaction of NOx with the electro-catalysts by applying visible light Raman spectroscopy onto working solid oxide cells (4).

The contribution will review the results obtained so far and outline the technological perspectives and challenges for electrochemical NOx filters in general.

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